

# New Columbariinae (Gastropoda: Turbinellidae) from the Indian Ocean

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## ABSTRACT

Four new species of Columbariinae are described from the Indian Ocean, based on museum material. *Coluzea kallistrophra* inhabits the lower continental slope off Mozambique and the KwaZulu-Natal coast of South Africa, and may easily be distinguished from its congeners by its lower spire and broad, flange-like peripheral keel. *Coluzea madagascarensis* occurs on the upper continental slope along the southwestern coast of Madagascar. Diagnostic features include long, radial spines along the shell periphery and strong spiral sculpture. *Columbarium quadrivaricosum* is presently known only from the upper continental slope off Transkei, South Africa. Its distinctive, thick, squarish varices serve to distinguish it from closely related species. *Coluzea naxa* is known only from its type locality along the uppermost continental slope off the Northwest Shelf of Western Australia. It is readily discerned from its geographically proximal congeners on the basis of its smaller, thinner, shell, prominent rounded axial sculpture, and posteriorly directed spines.

## INTRODUCTION

The subfamily Columbariinae represents an early [Maestrichtian (Darragh, 1969)] and diverse radiation of vermivorous Turbinellidae that has, since the Neogene, been restricted to habitats ranging from outer continental shelf to abyssal depths along continental margins. The subfamily is currently known from 52 Recent species and subspecies, with greatest diversity occurring along the western margins of ocean basins [western Atlantic Ocean = 11 species; western Indian Ocean = 14 species (3 new herein); western Pacific = 17 species and subspecies]. Six species (1 new herein) are presently known from the eastern Indian Ocean, and single species have been described from the eastern Pacific, the Antarctic, and the Bering Sea. The taxa described herein are based on specimens collected by the research vessels ANTON BRUN, MASCAREIGNES III, MEIRING NAUDÉ, and LADY BASTEN and housed in the collections of the National Museum of Natural History, Smithsonian Institution

(USNM), the Museum national d'Histoire naturelle, Paris (MNHN), the Natal Museum, Pietermaritzburg (NM), and the Western Australian Museum (WAM). While the increased sampling of soft bottom deep-sea habitats is likely to continue to bring additional columbarine taxa to light, the known fauna is beginning to provide insights into patterns of allopatric speciation and bathymetric zonation, as well as to common ecophenotypic adaptations in different oceans.

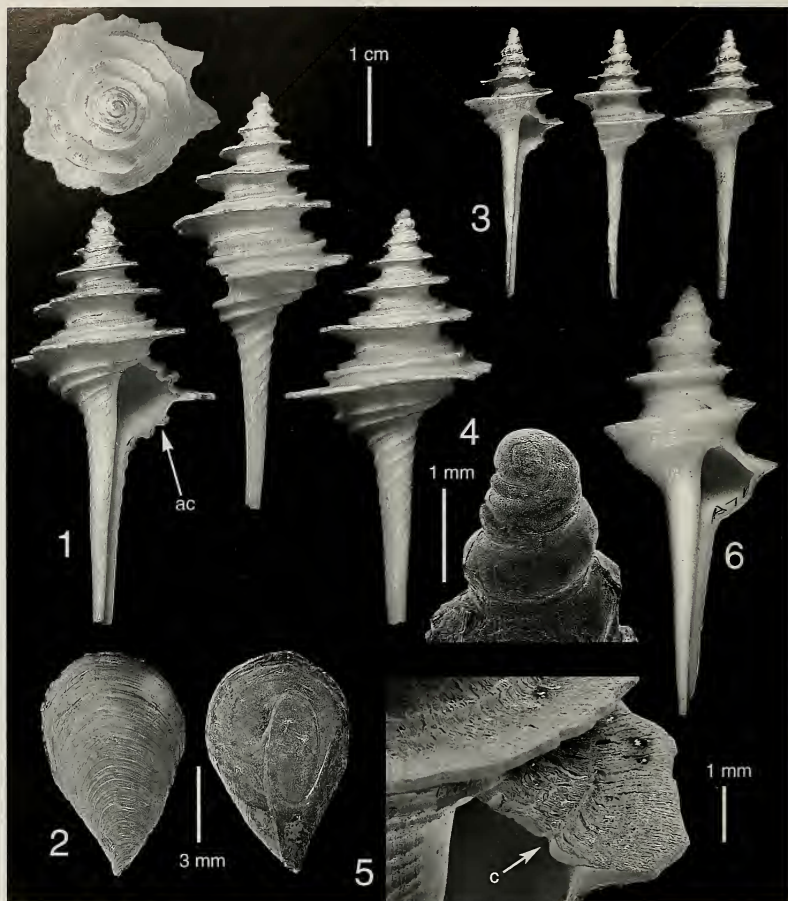
## SYSTEMATICS

Family Turbinellidae Swainson, 1840  
Subfamily Columbariinae Tomlin, 1928  
Genus *Coluzea* Allan, 1926

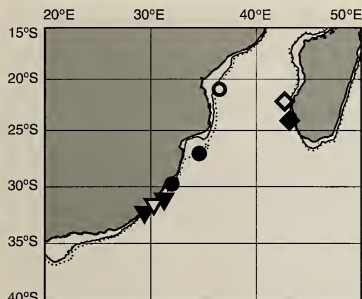
*Coluzea kallistrophra* new species  
(Figures 1–7)

**Diagnosis:** A moderate sized species with a narrow, fusiform, white shell with a broad, laterally oriented, flange-like keel along the shell periphery with an undulating edge and spiral threads along both surfaces. A weak but distinct anterior carina is present. Shoulder lateral. Spiral sculpture consists of 1–2 strong, rectangular, widely spaced spiral cords between the suture and the periphery, 1–3 cords between periphery and siphonal canal, and 5–8 along the proximal portion of the long, axial siphonal canal. Inner lip formed of a smooth glaze deposited after the outer shell layer of the previous whorl is resorbed.

**Description:** Shell (Figures 1, 3, 6) of moderate size (to 52 mm), thin to moderately heavy, fusiform; spire angle 35–43°. Protoconch (Figure 4) eroded, estimated to consist of 1½ inflated whorl, first whorl deflected from coiling axis of shell by 75–85°. Transition to teleoconch indistinct, eroded. Teleoconch extrapolated to consist of 8 strongly convex nearly triangular whorls. Suture abutted to previous whorl just anterior to strong cord forming anterior carina (Figure 1, ac). Earliest discernible sculpture consists of strong axial ribs (10 per whorl on



Figures 1-6. *Coluzoa kallistropa* new species. 1-2. Holotype [USNM 718517], 60 mi NE Ponta São Sebastião, Mozambique, 21°18' S, 36°18' E, in 1510-1600 m. 1. Apertural, right lateral, dorsal, and apical views of shell. 2. Outer and inner surfaces of operculum. 3-5. Paratype 1 [USNM 717921] 100 mi SE Lourenço Marques, Mozambique, 27°09' S, 34°09' E, in 1335 m. 3. Apertural, right lateral, and dorsal views of shell. 4. Lateral view of protoconch and early whorls. 5. Periostacrum between suture and shell periphery. 6. Paratype 2 [NM A76] Durban Bay, from dredgings dumped at head of bay. Scale bar (1 cm) applies to all entire shells. Abbreviations: ac, anterior carina, c, spiral cord.



**Figure 7.** Geographic distributions of new species of *Coluzea* and *Columbarium* from the western Indian Ocean. *Coluzea kallistropa* new species, open circle = type locality, solid circles = additional localities. *Coluzea madagascarensis* new species, open diamond = type locality, solid diamonds = additional localities. *Columbarium quadratiricosum* new species, open triangle = type locality, solid triangles = additional localities.

second teleoconch whorl) crossed by strong spiral cords (3 above and 3 below periphery). By third teleoconch whorl, short, broad, open, laterally directed spines form along periphery. By fourth teleoconch whorl, axial ribs diminish in prominence; spines fuse to form continuous peripheral keel with 3 weaker spiral cords above, and two below the keel. By fifth teleoconch whorl, axial sculpture becomes indistinct except for fine growth lines, keel increases in size. Spiral sculpture becomes more pronounced, with 1–2 strong hollow cords between suture and periphery, 1–3 between periphery and siphonal canal, 5–8 along proximal portion of siphonal canal, decreasing in prominence distally. Finer spiral threads (1–3) between adjacent cords, 7–12 undulating threads along adapical and abapical surfaces of peripheral keel. Aperture broadly ovate, roughly triangular, sharply tapering anteriorly, deflected from shell axis by 23–26°. Outer lip glazed, furrows beneath spiral cords, deepest beneath peripheral keel. Inner lip smooth, outer shell layer comprising surface sculpture resorbed along parietal region, columella and siphonal canal prior to deposition of thin porcellaneous glaze. Siphonal canal long, axial, stout, straight. Shell color uniformly white. Periostracum (Figure 5) thin, straw-colored, lamellose and finely hirsute, forming low, broad tufts along spiral cords and threads (Figure 5, c). Operculum (Figure 2) thin, claw-shaped, broadly rounded posteriorly, sharply tapering anteriorly, leading to a terminal nucleus. Inner surface with thin glaze covering anterior region and nucleus, defining rounded attachment region. Soft tissues, radula unknown.

**Type Locality:** 60 mi NE Ponta São Sebastião, Mo-

zambique, 21°18' S, 36°18' E, in 1510–1600 m, Gulf of Mexico Shrimp Trawl, ANTON BRUUN Cruise 8, sta. 399C, 2 October 1964.

**Type Material:** Holotype, USNM 718517, 51.35 mm, from the type locality; Paratype 1, USNM 717921, 26.60 mm, 100 mi SE Lourenco Marques, Mozambique, 27°09' S, 34°09' E, in 1335 m, ANTON BRUUN Cruise 7, sta. 374C, 23 August 1964; Paratype 2, NM A76, 42.22 mm, Durban Bay, from dredgings dumped at head of bay, 2 December 1972.

**Distribution (Figure 7):** The presently known range of this species extends from southern Mozambique southward to KwaZulu-Natal, South Africa, at depths of 1335 to 1600 m.

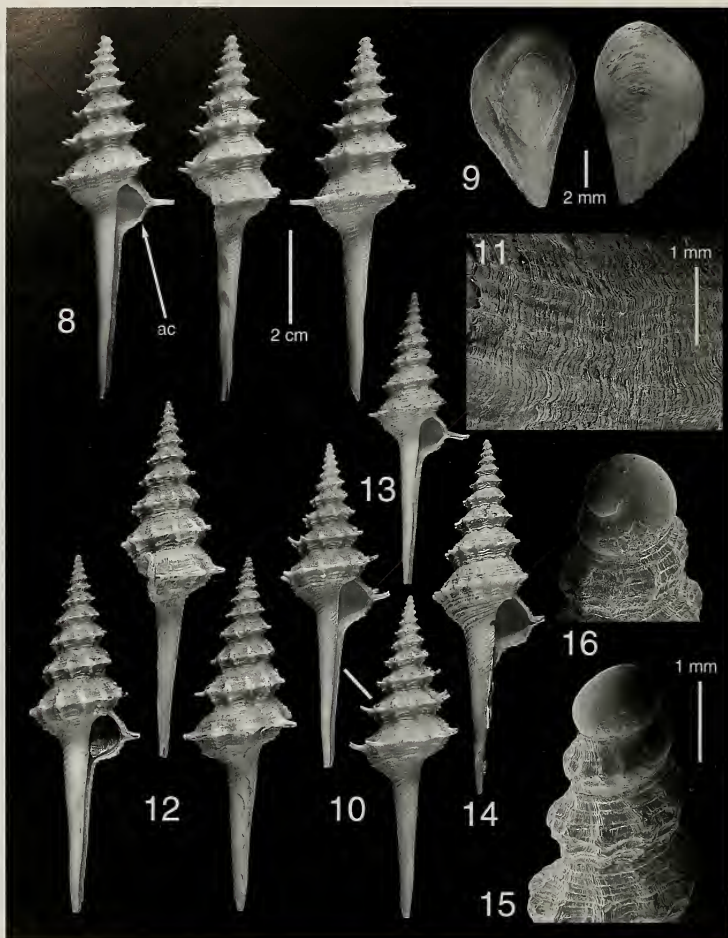
**Etymology:** *Kallistropa* = *kallimos*—Greek, beautiful + *strophe*—Greek, a turning, twist.

**Remarks:** *Coluzea kallistropa* is most closely related to *Coluzea eastwoodae* Kilburn, 1971, and *Coluzea juliae* Harasewych, 1989, but may easily be distinguished from both by its broad, flange-like peripheral keel, and by the sculpture between the suture and peripheral keel (smooth in *C. eastwoodae*; 2–3 broad, squarish hollow cords in *C. juliae*; 1–2 strong, narrow cords in *C. kallistropa*). These three species inhabit the same geographic area off the southeastern coast of Africa, but have different bathymetric ranges. *Coluzea eastwoodae*, the most widely sampled species, has been reported from depths ranging from 150 to 740 m, with the deepest live taken specimen presently known being from 570 m. Based on the few specimens of *C. juliae* to be sampled with precise depth data, the confirmed bathymetric range for this species is 600 to 700 m. The two live collected types of *C. kallistropa* were collected along the lower continental slope, at depths of 1335 to 1600 m, among the deepest for any species of Columbariinae. While most living Columbariinae occur on sand and mud bottoms along the outer continental shelf and upper continental slope, two species of *Fulgurofusus*, *F. benthoicallis* (Melville and Standen, 1907) and *F. aequilonius* Syssoev, 2000, are known to occur on the abyssal plain in polar regions, the former off the South Orkney Islands, the latter in the Bering Sea.

It is interesting to note that a phenotype with a broad, laterally directed, flange-like keel occurs in most regions with a high diversity of columbariines (e.g., *Fulgurofusus brayi* Clench, 1959—western Atlantic; *Coluzea kallistropa*—western Indian Ocean; *Coluzea altocanalis* (Dell, 1956)—New Zealand; *Columbarium pagodoides* (Watson, 1852)—eastern Australia), suggesting that the morphology may be an ecophenotypic response to a particular substrate or habitat.

*Coluzea madagascarensis* new species  
(Figures 7–17)

**Diagnosis:** A large species, with heavy, narrow, fusiform shell, prominent and persistent strongly shouldered



**Figures 8-16.** *Coluzea madagascarensis* new species. **8-9.** Holotype [MNHN], off SW Madagascar, 22°18' S, 43°05' E, in 450-500 m. **8.** Apertural, right lateral, and dorsal views of shell. **9.** Outer and inner surfaces of operculum. **10-11.** Paratype 1 [USNM 1018395], off SW Madagascar, 22°17' S, 43°04' E, in 425-450 m. **10.** Apertural and dorsal views of shell. **11.** Periostracum. **12.** Paratype 2 [MNHN], off SW Madagascar, 22°16' S, 43°06' E, in 360-415 m. **13.** Paratype 9. **14.** Paratype 10, both [MNHN], off SW Madagascar, 23°36.4' S, 43°31.1' E, in 450-460 m. **15-16.** Views of the protoconch of Paratype 6. [MNHN], off SW Madagascar, 22°14.8' S, 43°04.7' E, in 450 m. Scale bar (2 cm) applies to all entire shells.





**Figure 17.** *Coluzea madagascarensis* new species. Left lateral and dorsal views of radular teeth at mid-length of radular ribbon.

axial ribs [9–10 on body whorl], each with a long, axially oriented, open spine along the periphery. Anterior carina weakly developed. Shoulder sloping, with 5–8 distinct cords between suture and periphery, 2–3 between periphery and weak anterior carina, 5–6 between carina and base of siphonal canal, 25–30 along proximal  $\frac{2}{3}$  of long, axial siphonal canal. Inner lip of smooth glaze deposited after outer shell layer of previous whorl resorbed.

**Description:** Shell (Figures 8, 10, 12–14) large (to 78 mm), moderately heavy, strongly fusiform; spire angle 28–34°. Protoconch (Figures 15–16) of about  $\frac{1}{4}$ – $\frac{1}{2}$  smooth, glassy, inflated whorls, first whorl smaller than second, deflected from shell axis by about 80°. Transition to teleoconch indistinct, marked by formation of a peripheral keel, followed within  $\frac{1}{4}$  whorl by axial ribs, then by spiral cords above and below periphery. Teleoconch of up to 10 $\frac{1}{2}$  evenly convex whorls with strong peripheral carina bearing tubercles on early whorls that change to long, open, radially oriented spines by sixth postnuclear whorl. Suture abutted to previous whorl just anterior to dominant spiral cord that forms weak anterior carina (Figure 8, ac). Axial sculpture begins within  $\frac{1}{4}$  whorl of transition to teleoconch, consists of 8–10 strongly shouldered ribs that extend from suture to suture on first teleoconch whorl. Axial ribs overlaid by strong, evenly rounded spiral cords, 3–4 above, 2–3 below periphery. By sixth teleoconch whorl, short, open, spines perpendicular to coiling axis appear along periphery, supporting axial ribs become broader, more prominent near periphery, less so near sutures. As shoulder spines become longer, more pronounced in subsequent whorls [9–10 on body whorl], axial ribs become less discernible. Spiral cords increase in number and prominence with increasing whorl number (body whorl: 5–8 between suture and periphery, 2–3 between periphery and weak anterior carina, 5–6 between carina and base of siphonal canal, 25–30 along proximal  $\frac{2}{3}$  of siphonal canal, becoming weaker, less distinct distally). Aperture broadly ovate, rounded abaxially, tapering anteriorly, deflected from coiling axis by 26–29°. Outer lip thin. Furrow beneath periphery deepest and widest beneath

spines. Second, weaker furrow beneath anterior carina. Inner lip smooth, sculptural elements on outer shell layer resorbed prior to deposition of thin porcellaneous glaze. Siphonal canal long ( $\sim 0.46$  shell length), axial, stout, weakly twisted along distal half. Shell color uniformly white. Periostracum (Figure 11) moderately thick, yellowish brown, of closely spaced lamellae, weakly hirsute along spiral cords (evident in early whorls). Operculum (Figure 9) moderately thin, rounded, tapering to terminal nucleus. Inner surface with rounded glaze along nucleus, surrounding attachment area.

Holotype a mature, poorly preserved, female, with mantle cavity spanning  $\sim \frac{3}{4}$  whorl, kidney, upper whorls not recovered. Animal light tan colored. Foot, small, rectangular. Retracted tentacles, short, conical; eyes absent. Disposition of mantle cavity and cephalic haemocoel organs similar to *Coluzea aapta* (see Harasewych, 1986:161). Proboscis, long, convoluted within proboscis sheath. Radula (Figure 17) short (3.3 mm), narrow (153  $\mu$ m), with 116 rows of teeth. Rachidian teeth with 3 short, stout cusps spanning anteriorly indented middle half of basal plate that broadens laterally.

**Type Locality:** SW Madagascar, 22°18' S, 43°05' E, in 450–500 m, Chalutier "MASCAREIGNES III", sta. 33, 20 January 1986.

**Type Material:** Holotype, MNHN, 77.50 mm, from the type locality; Paratype 1, USNM 1018395, 65.53 mm, SW Madagascar, 22°17' S, 43°04' E, in 425–450 m, Chalutier "MASCAREIGNES III", sta. 6, 21 December 1985; Paratype 2, MNHN, 67.50 mm, SW Madagascar, 22°16' S, 43°06' E, in 360–415 m, Chalutier "MASCAREIGNES III", sta. 41, 22 January 1986; Paratype 3, MNHN, 78.32 mm, SW Madagascar, 22°14.7' S, 43°04.5' E, in 470–475 m, Chalutage 114, 2 December 1973; Paratype 4, MNHN, 72.72 mm, SW Madagascar, 22°18' S, 43°05' E, in 425 m, Chalutier "MASCAREIGNES III", sta. 13, 23 December 1985; Paratype 5, MNHN, 54.87 mm, SW Madagascar, 22°21.6' S, 43°04.3' E, in 450 m, Chalutage 95, 27 November 1973; Paratype 6, MNHN, 69.62 mm, SW Madagascar, 22°14.8' S, 43°04.7' E, in 450 m, Chalutage 115, 2 December 1973; Paratypes 7, 8, MNHN, 58.17 mm, 58.89 mm, SW Madagascar, 22°17.9' S, 43°04' E, in 450 m, Chalutage 105, 29 November 1973; Paratypes 9, 10, MNHN, 63.11 mm, 74.05 mm, SW Madagascar, 23°36.4' S, 43°31.1' E, in 450–460 m, Chalutage 66, 29 February 1973; Paratype 11, Ritter collection, trawled off Tuléar, Madagascar, in 600–799 m, dead collected, June 2002.

**Distribution (Figure 7):** *Coluzea madagascarensis* new species occurs off the southwestern coast of Madagascar. The confirmed bathymetric range is 415–470 m, although dead-collected specimens have been taken at depths between 600 and 799 m.

**Etymology:** *madagascarensis* = Madagascar + *ensis*—Latin, belonging to.

**Remarks:** *Coluzea madagascarensis* is intermediate in

morphology between *C. eastwoodae* from off southeastern Africa and *C. distephanotis* (Melville, 1891) from off northwestern Australia, all occurring at comparable depths. It may be distinguished from *C. eastwoodae* by its more elongate, fusiform shell, spiral sculpture that is stronger, more uniform in size and more uniformly distributed (*C. eastwoodae* lacks spiral sculpture between suture and periphery), and by having fewer, longer, axially oriented spines along the periphery. *Coluzea madagascarensis* differs from *C. distephanotis* in having a less tabulate shoulder, stronger spiral sculpture between suture and periphery, and spines that are axially rather than posteriorly directed along the periphery. Both *C. eastwoodae* and *C. distephanotis* have a prominent anterior carina, which is barely distinguishable in *C. madagascarensis*.

*Columbarium quadratvaricosum* new species  
(Figures 7, 18–23)

**Diagnosis:** A small species with a gradate spire, fusiform, white shell, with tabulate, squarish whorls, axial sculpture of thick, rounded varices [8–9 per whorl] and spiral sculpture of distinct cords, square in profile, strongest on periphery and anterior carina. Inner lip formed by a thickly glazed peristomal plate that overlies the columella and proximal siphonal canal.

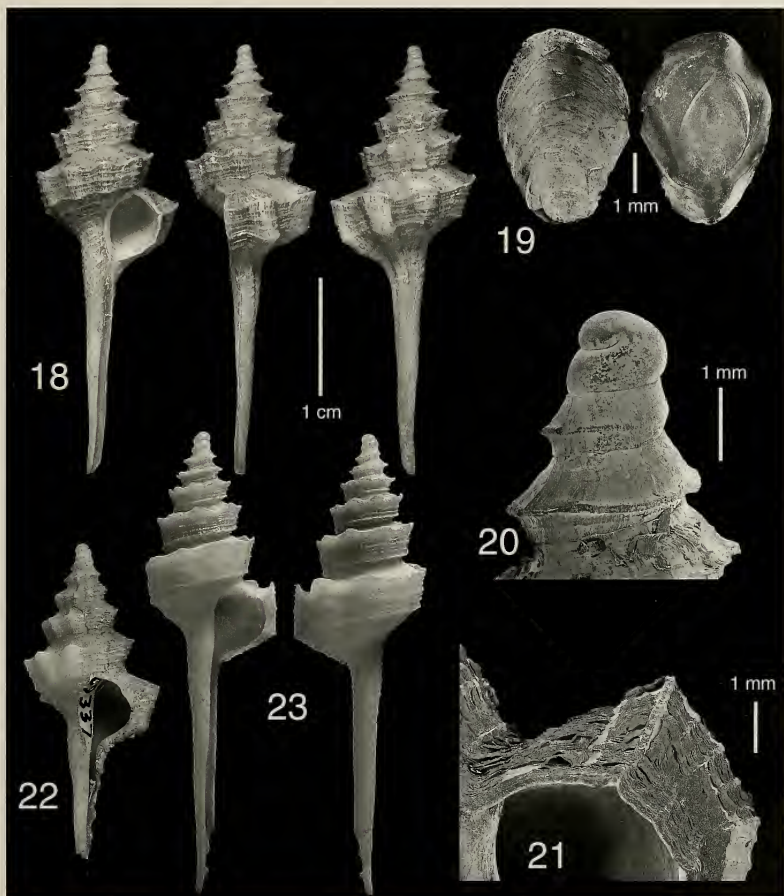
**Description:** Shell (Figures 18, 22, 23) small (to 45 mm), thick to moderately thin, fusiform, with squarish varices. Spire angle 46–51°. Protoconch (Figure 20) of about 1½ smooth, glassy whorls. First whorl inflated, deflected from coiling axis by 67–72°. Transition to teleoconch distinguished by onset of peripheral keel, rounded at first, becoming keel-like, with broad, undulating axial nodes within ½ whorl. Teleoconch of up to 7 strongly shouldered, nearly tabulate, squarish whorls. Suture adpressed to previous whorl anterior to anterior carina. Earliest sculpture, apart from very fine growth striae visible on all teleoconch whorls, consists of broad, rounded axial nodes along peripheral keel (8–9 per whorl) that become narrower, more sharply defined, supported by axial ribs of increasing prominence by third teleoconch whorl. By fourth teleoconch whorl, axial ribs form broad, solid varices, thickest between peripheral keel and anterior carina, producing a square whorl profile, with nearly tabulate shoulder. Spiral sculpture first appears on second teleoconch whorl, as single cord below peripheral keel. By third teleoconch whorl, 2–3 weak cords or threads appear above peripheral keel. Body whorl with 4–5 strong, square, equally spaced cords between suture, peripheral keel; 1 strong cord between major cords along peripheral keel, anterior carina; 4–5 cords between anterior carina, siphonal canal; 7–10 cords on proximal ½ of siphonal canal. Finer threads between adjacent cords, suture to keel (0 threads); keel to carina (1–3 threads); carina to siphonal canal (1–2 threads); siphonal canal (0–1 threads). Aperture broadly ovate, nearly rounded, tapering anteriorly, deflected from shell

axis by 23–29°. Outer lip thickly glazed, with furrows beneath suture, peripheral keel, anterior carina extending to nearest varix. Inner lip smooth, thickly glazed, peristomal plate overlaying columella, proximal portion of siphonal canal. Siphonal canal long, axial, stout, straight. Shell color uniformly white. Periostacrum (Figure 21) thick, amber colored, lamellose. Operculum (Figure 19) thin, ovate, broadly rounded posteriorly, with terminal nucleus. Inner surface with rounded attachment area. Soft tissues, radula, unknown.

**Type Locality:** Off Mendu Point, Transkei, South Africa, 32°21.8' S, 29°00.0' E, in 300 m, on coarse sand, R/V MEIRING NAUDÉ, sta. R 10, 12 July 1984.

**Type Material:** Holotype, NM C 6279, 36.87 mm, from the type locality; Paratype 1, USNM 1018396, 39.79 mm, off Qora River, Transkei Region, Eastern Cape, South Africa, 33°33.6' S, 28°48.8' E, in 300 m, coarse sand, some broken shell, R/V MEIRING NAUDÉ, sta. U 10, 11 July 1984; Paratype 2, NM C 1802, 28.67 mm, off Bulungula River, Transkei Region, Eastern Cape, South Africa, 32°13.7' S, 29°08.7' E, in 250–270 m, muddy sand, old shell debris, R/V MEIRING NAUDÉ, sta. 17 July 1982; Paratype 3, NM C 6377, 27.52 mm, off Mendu Point, Transkei Region, Eastern Cape, South Africa, 32°24.0' S, 28°59.0' E, in 250 m, coarse sand, rubble, few sponges, R/V MEIRING NAUDÉ, sta. R11, 12 July 1984; Paratypes 4, 5, NM C4911, 44.77 mm, 35.81 mm, off Mendu Point, Transkei Region, Eastern Cape, South Africa, 32°22.6' S, 29°00.4' E, in 250–260 m, dredged on coarse sand; R/V MEIRING NAUDÉ, sta. R 7, 8 June 1983; Paratype 6, NM C9337, 26.75 mm, off Bulungula River, Transkei Region, Eastern Cape, South Africa, 32°14.0' S, 9°08.6' E, in 250–300 m, dredged on coarse sand, R/V MEIRING NAUDÉ, sta. O10, 5 June 1985; Paratype 7, NM C6304, 20.02 mm, off Qora River, Transkei Region, Eastern Cape, South Africa, 33°34.2' S, 28°48.1' E, in 270 m, dredged on old shell bottom, R/V MEIRING NAUDÉ, sta. U 11, 11 July 1984; Paratype 8, NM C6573, 28.40 mm, off Qolora River, Transkei Region, Eastern Cape, South Africa, 32°47.6' S, 28°36.6' E, in 510 m, dredged on sandy mud, R/V MEIRING NAUDÉ, sta. Y 12, 14 July 1984; Paratype 9, NM C6468, 16.46 mm, off Shixini Point, Transkei Region, Eastern Cape, South Africa, 32°31.4' S, 28°52.5' E, in 400–420 m, dredged on coarse sand, fine shell rubble, R/V MEIRING NAUDÉ, sta. T 16, 12 July 1984; Paratypes 10, 11, NM C8668, 38.33 mm, 29.35 mm, off Nthlonyane River, Transkei Region, Eastern Cape, South Africa, 32°18.2' S, 20°06.2' E, in 550 m, dredged on sand, stones, broken *Dendrophyllia*, R/V MEIRING NAUDÉ, sta. P 13, 5 July 1985; Paratype 12, NM C8946, 33.39 mm, off Mgazi River, Transkei Region, Eastern Cape, South Africa, 31°44.3' S, 29°32.2' E, in 250 m, dredged on muddy sand, R/V MEIRING NAUDÉ, sta. J 11, 4 July 1985.

**Distribution (Figure 7):** *Columbarium quadratvaricosum* has been collected at multiple stations, all in a narrow range [31°34'–33°34' S] off the Transkei Region,



Figures 18–23. *Columbarium quadraticaricosum* new species. 18–21. Holotype [NM C 6279], off Mendu Point, Transkei, South Africa, 32°21.8' S, 29°00.0' E, in 300 m. 18. Apertural, right lateral, and dorsal views of shell. 19. Outer and inner surfaces of operculum. 20. Lateral view of the protoconch. 21. Periostacum. 22. Paratype 6 [NM C9337], off Bulungula River, Transkei, South Africa, 32°14.0' S, 9°08.6' E, in 250–300 m. 23. Paratype 1 [USNM 1018396], off Qora River, Transkei, South Africa, 33°33.6' S, 28°48.8' E, in 300 m. Scale bar (1 cm) applies to all entire shells. Abbreviation: ac, anterior carina.



Eastern Cape, South Africa, at depths ranging from 250 to 550 m. Specimens from depths in excess of 420 m were all dead collected and extremely worn.

**Etymology:** *quadrativaricosus* = *quadratus*—Latin, squared + *varicosus*—Latin, varicose or ridged.

**Remarks:** *Columbarium quadrativaricosum* is related to the group of southern African congeners characterized by the presence of thick, rounded varices, including *C. subcontractum* (Sowerby, 1902), *C. formosissimum* Tomlin, 1928, and *C. natalense* Tomlin, 1928. It most closely resembles *C. subcontractum*, which inhabits a similar bathymetric range, but appears to be allopatric, based on limited records that indicate a range to the north of Durban Bay. While these two species reach comparable shell length, *C. quadrativaricosum* has a thinner shell, a proportionally shorter, more gradate spire, a smaller, rounder aperture, a longer, thinner siphonal canal, a tabulate shoulder, and varices that are squarish rather than triangular. It also closely resembles *C. natalense*, which has a comparable geographic range, but inhabits shallower depths [90–160 m]. *Columbarium natalense* can be distinguished from *C. quadrativaricosum* based on its pigmented shell (reddish brown with lighter spiral cords and distal portion of siphonal canal), spiral sculpture of cords that are not continuous, but posteriorly recurved along each varix, the presence of a long, open spine at the shoulder of each varix, and an extremely pronounced cord along the anterior carina. The much larger *C. formosissimum*, which has a more southerly distribution [Cape St. Blaize to Port Alfred] and shallower bathymetric range [121–165 m], may also be distinguished by its heavier proportions more similar to *C. subcontractum*, its reduced or absent spiral sculpture, and its weaker varices that develop at a larger shell size.

*Coluzea naxa* new species  
(Figures 24–30)

**Diagnosis:** A small species with thin, narrowly fusiform, white shell with gradate spire. Sculpture of strong axial ribs and open, recurved, posteriorly directed spines along shoulder. Spiral sculpture of strong cords that overlay axial ribs, 3 between suture and periphery, 2 between periphery and anterior carina, 4 between anterior carina and siphonal canal, and 12–15 along proximal  $\frac{2}{3}$  of siphonal canal. Inner lip of thin glaze deposited after columellar surface of previous whorl resorbed.

**Description:** Shell (Figures 24, 29) small (to 52 mm), thin, narrowly fusiform; spire angle 33–34 $\frac{1}{2}$ °. Protoconch (Figure 26) of about 1 $\frac{1}{2}$  worn bulbous whorls, first whorl deflected from coiling axis of shell by 80–90°. Transition to teleoconch marked by onset of weak keel along shoulder, forming axial ribs and flanked by spiral cords above and below within first teleoconch whorl. Teleoconch of 9  $\frac{1}{2}$  convex, strongly shouldered whorls. Suture abutted to previous whorl just anterior to anterior

carina (Figure 24, ac). Axial sculpture initially of 11–13 strong ribs per whorl that originate at the shoulder but do not extend to the anterior carina. Ribs become heavier, increase in number to 15–19 on final whorl, and develop open, curved, posteriorly-directed spines along shoulder by 3rd postnuclear whorl. Spiral sculpture of 3 strong cords between suture and periphery, 2 major cords between periphery and anterior carina, 4 strong cords between anterior carina and siphonal canal, and 12–15 major cords along proximal  $\frac{2}{3}$  of siphonal canal. One to three weaker cords present between adjacent major cords anterior of shoulder. Aperture broadly ovate, tapering anteriorly, deflected from shell axis by 17°. Outer lip glazed, slightly reflected, forming posteriorly directed, open spine at shoulder. Weak furrows on inner surface of outer lip correspond to shoulder and major spiral cords. Inner lip smooth, surface sculpture resorbed prior to deposition of thin porcellaneous glaze. Siphonal canal long, axial, stout, straight. Shell color uniformly white. Periostracum (Figure 25, per) thin, of overlapping axial lamellae, straw-colored. Operculum (Figure 27) thin, wedge-shaped, broadly rounded posteriorly, sharply tapering anteriorly, slightly concave along right side leading to a terminal nucleus.

Holotype a mature, poorly preserved, desiccated female, with mantle cavity spanning  $\sim\frac{3}{4}$  whorl, kidney  $\sim\frac{1}{2}$  whorl, upper whorls not recovered. General orientation and morphology of mantle cavity and cephalic hemocoel organs as in *Coluzea aapta* (see Harasewych, 1986:161). Proboscis, long, tightly folded in proboscis sheath, which occupied posterior half of cephalic hemocoel. Radula (Figure 28) short (3.2 mm), narrow (132  $\mu$ m), with 142 rows of teeth. Lateral teeth monocuspid, recurved, tapering to a point from 20  $\mu$ m wide attachment area. Rachidian teeth with 3 well-defined, closely spaced, posteriorly-directed cusps emanating from the center of a semicircular basal plate that expands laterally.

**Type Locality (Figure 30):** Off Western Australia, North West Shelf, 33 nautical miles S of Bedwell Island, Clerke Reef, 17°46.76' S, 119°24.6' W to 17°45.97' S, 119°25.6' W, in 250 m, AIMS Survey R/V LADY BASTEN station LBS, 18 August 1995, Sled dredge, substrate of calcareous mud and worm tubes.

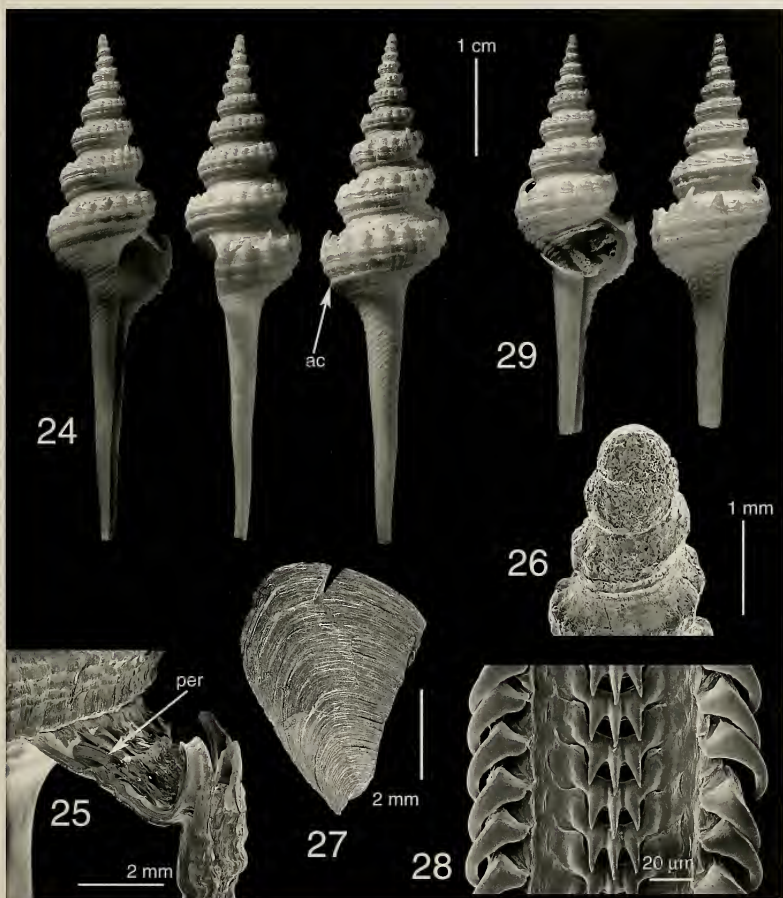
**Type Material:** Holotype, ♀, WAM S14314, 52.1 mm; Paratype, WAM S14394, 40.1 mm, (with hermit crab), both from the type locality.

**Distribution (Figure 30):** This species is presently known only from its type locality.

**Etymology:** *naxa*—Latin, wicker basket with a narrow neck.

**Remarks:** The narrow, fusiform shell, presence of strong axial ribs that originate at the shoulder but do not extend to the anterior carina, and open, posteriorly reflected spines of *Coluzea naxa* serve to distinguish it from all congeners. *Coluzea naxa* is conchologically most similar to the New Caledonia species, *Coluzea faceta*





**Figures 24–29.** *Coluzea naxa* new species. Dredged off Western Australia, North West Shelf, 33 nautical miles S of Bedwell Island, Clerke Reef, 17°46.76' S, 119°24.6' W to 17°45.97' S, 119°25.6' W, in 250 m. 24–28. Holotype [WAM S14314]. 24. Apertural, right lateral and dorsal views of shell. 25. Detail showing periostracum and open spines along shoulder. 26. Protoconch. 27. Outer surface of operculum 28. Dorsal view of mid-section of radular ribbon. 29. Paratype [WAM S14394]. Scale bar (1 cm) applies to all entire shells. Abbreviations: ac, anterior carina; per, periostracum.

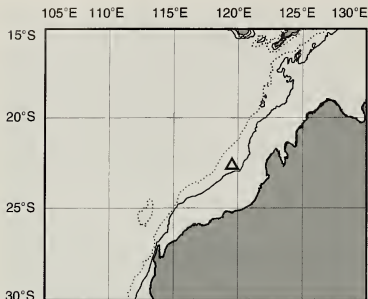


Figure 30. Geographic distribution of *Coluzea naxa* new species, open triangle = type locality.

Harasewych, 1991, which differs in having a larger, heavier shell, with stronger axial ribs that extend beyond the anterior carina, short, laterally directed spines, a broader aperture and narrower shoulder.

*Coluzea naxa* is easily distinguished from the three geographically more proximal, bathymetrically zoned species *C. distephanotis* (Melvill, 1891), *C. icarus* Harasewych, 1986, and *C. aapta* Harasewych, 1986 [from off Rowley Shoals, Western Australia] by its smaller,

thinner, shell, prominent rounded axial sculpture, and posteriorly directed spines. Although *C. distephanotis* was originally described from a depth of 31 m (Melvill, 1891), more recent, better-documented samples indicate that this species inhabits depths in excess of 300 m (Harasewych, 1986), while *C. icarus* and *C. aapta* live at even greater depths along the continental slope. As *Coluzea naxa* is presently known only from a single station at a depth of 250 m, additional sampling will be required to determine the geographic and bathymetric boundaries among these species.

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